

## REMARKS:

### Claim Objections:

Claims 66 and 67 are amended to remove the dependency on earlier recited multiple dependent claims.

Claims 49 and 52 are amended to recite the limitations as independent claims.

### Claim Rejections under 35 U.S.C. §101:

Applicant respectfully traverses the Examiner's objection that the Claims 20-62 are over a non-statutory process. The acts of the claimed process do not "manipulate only numbers or abstract concepts." A "radiation count" is a commonly used term to describe the detection of a radioactive particle or quanta of electromagnetic radiation. For example, in the Specification, page 2 line 13, the statement is made "... counts received by each of the detectors ...." Whether or not "radiation count" is a term known in the art, the applicant is free to be its own lexicographer. Therefore, the "count" or "radiation count" refers to the instance of a detection. The specification describes the detection process, on page 4, line 5, "For gamma rays that have all their energy converted to light, i.e. they are completely absorbed, the MCA [Multi Channel Analyzer] puts those counts into a few channels ....." According to MPEP §2106(b)(i), a statutory safe harbor includes "one that requires the measurements of physical objects or activities to be transformed outside of the computer into computer data..." One of the examples given includes "... the X-rays are converted into electrical digital signals that represent the condition of the human body..." In this case, the "measuring" step recites measurement of a physical activity: the receipt of radioactive particles and waves into the detector.

With regard to Claim 63-65, the same argument applies: "radiation event" is the physical activity that is converted into digital signals, e.g. radiation counts, that represent that event. Therefore, Claim 63-65, as amended cover statutory matter under 35 U.S.C. §101.

### Claim Rejections under 35 U.S.C. §112:

Applicant has amended claims 20, 32, 46, 53 in order to clarify that the measured radiation counts correspond to time slices or detectors. Therefore all of the dependent claims have this same limitation.

With regard to whether the limitation "calculating a correlation" is unclear, the claims have been amended to clarify that the correlation is among the individual radiation counts associated with each of the corresponding time slices or detectors. The specification clearly lays out this novelty on page 5, line 15. Therefore, the Examiner is incorrect to say that the "measured counts" is a single variable. Each detector, time slice or energy window has a measured count. Therefore, there is more than one of these, in each case and thus the correlation is always being made over at least two variables.

Regarding Examiner's comment that "for purposes of this office action, the correlation will be considered as any relationship of the measured counts." Respectfully, the Examiner appears to misunderstand the point of novelty due to a misunderstanding of "correlation" as understood in the field of radiation physics, mathematics and engineering. The invention involves the use of "correlation" as a way to extract radiation source measurements from background source noise. The Examiner is incorrect to say that "...in general, a correlation is a relationship between two variables ..." or that it is "any relationship." The definition of "correlation" is, according to the Merriam-Webster dictionary, "a relation existing between phenomena or things or between mathematical or statistical variables which tend to vary, be associated, or occur together in a way not expected on the basis of chance alone..." <http://www.m-w.com/dictionary/correlation>. Hence, any arithmetic relationship does not qualify as a correlation. This is clearly explained in the specification on page 5 line 14 and following. Therefore, where the Examiner expands the meaning of "correlation" to include averaging and other ways of combining numbers that do not involve correlation, the Examiner is expanding the breadth of the claims improperly. The MPEP §2111.01 (ii) states that "the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill on the art ...." In this case, it is well known among physicists, engineers and certainly mathematicians that "correlation" is not any relationship, but rather determining whether two or more events occur together in a way not expected by background radiation alone, as explained with respect to an embodiment of the invention on page 4, line 15 and following.

The applicant respectfully traverses Examiner's statements that "it is noted that in general, a correlation is a relationship between two variables ...", "the correlation will be considered as any relationship of the measured counts...", "calculating a correlation (i.e. relationship)"—thus implying the logical leap from the claim term "correlation" to any numerical relationship—and "the relationship, such as an average is viewed as a matter of routine design choice." In light of applicant's explanation that a "correlation" among a set of variables does not include all possible arithmetic relationships and certainly does not include merely summing the variables or averaging their values, applicant requests Examiner to provide documentary evidence supporting each of these assertions, pursuant to 37 CFR 1.104(C)(2).

Claim 45 has been amended to define "e" as the base of the natural logarithm, that is, Euler's constant.

#### Claim Rejections under 35 U.S.C. §103:

Applicant respectfully traverses Examiner's finding of obviousness. 35 U.S.C. §103 does not permit the Examiner to distill the invention to a gist of its novelty by means of conflating the "correlation" claim term with every other numerical relationship found in the prior art. See MPEP 2141.02(ii). This improperly ignores this claim limitation.

With regard to claims 20 and 32, as compared to Mallette, it is not a "routine design choice" to select between the "type of relationship", that is between calculating a correlation between (i) radiation counts associated with two or more detectors, time slices or energy channels, or (ii) averaging such data. As explained above, "correlation" does not include "any relationship" between two numbers. Mallette discloses a system that sums the detector counts and then

averages them. This is not nearly a correlation. The reason is simple: under Mallette in paragraph 35, if detector one has A counts and the other B, while in another instance, the reverse is true, in both cases, the average number of counts detected (according to Mallette) “summed and averaged” and therefore a value of  $(A+B)/2$  is produced. Yet as noted above, an “average” of A and B is not the same as calculating whether A and B’s events are “correlated.” Therefore Mallette’s disclosure does not disclose nor suggest calculating whether the detector measurements are correlated across time slices or detectors.

Claim 20, 32, 46, 63.

Applicant respectfully traverses Examiner’s finding of obviousness in light of Mallette. Mallette’s technique takes several detectors and averages their detection measurements. See paragraphs 0029 and 0035. As explained above it is possible with Mallette’s technique for a strong signal in one detector and no signal in the other, to produce the same result as if the case where there is only a weaker, correlated signal in both. However, the latter case is correlated while the former is not. Mallette’s technique would not distinguish the two results, while Applicant’s invention would.

Regarding claim 46, the Examiner is incorrect to say that increasing the number of time slices is the same as increasing the detection time. The same argument made above with regard to detectors A and B applies to time slices A and B. In accordance with the applicant’s disclosure, the counts from A and B have to be sufficiently correlated to indicate a radioactive source. Meanwhile, simply adding time slices together does not both improve sensitivity and control the false positive rate. As I am sure Examiner is familiar, by analogy, turning up the gain on a measuring amplifier increases the sensitivity but also increases the noise. Hence, the signal to noise ratio is never improved by increasing gain alone. Same here. Increasing gain as disclosed in Mallette is simply increasing measuring time (or, for that matter, the number of detectors). But that also increases background noise. Only by using correlation can the noise level, i.e. the false positives due to background, be reduced while increasing sensitivity. The point of correlation is to increase the sensitivity while not appreciably increasing the noise level.

Applicant respectfully traverses Examiner’s statement that “it is well known that, in general, increasing detection time allows for a more accurate determination.” Correlation of measurements across time slices is not the same as simply adding the measurements together. As discussed earlier, turning up the sensitivity of the measurement of radiation by increasing the time period or having more detectors and summing them also increases the number of detected counts from background. This increases the sensitivity of the measurement, but does not change the ratio of background counts to radiation counts. Therefore, the signal to noise ratio, so to speak, essentially remains the same and there is no further “accurate determination” even though the sensitivity of the measurement has increased. This is commonly known signal engineering.

Claim 21:

With regard to Kruse, note that at 5, 57, it states “The microprocessor compares the mean of the counts ....” This implies that the microprocessor has already calculated the mean of the counts. A “mean” is the same as an “average”. The Merriam-Webster dictionary defines an “arithmetic

mean” as “a value that is computed by dividing the sum of a set of terms by the number of terms.” It also defines “average” as “the quotient obtained by dividing the sum total of a set of figures by the number of figures.” See <http://www.m-w.com/dictionary/average>, <http://www.m-w.com/dictionary/arithmetic%20mean>. Therefore, Kruse’s technique does not disclose calculating a “correlation” between the measurements.

As a result, Applicant respectfully traverses Examiner’s reasoning on page 6 of the office action where Examiner states that Mallette in combination with Kruse teaches a “correlation.”

With regard to Horrocks, the paragraph cited by the Examiner does disclose taking radiation measurements in an energy window, but the paragraph does not disclose correlating the counts detected in more than one energy window to see if the correlated counts are consistent with a radiation source as opposed to a background source.

With regard to the Iwatschenko-Borho reference (referred to herein as “Borho”), the U.S. application describes the system in general, but leaves the detail regarding the “NBR” processor to the ‘124 German patent application, which was incorporated by reference. It is not clear how the NBR processor determines whether there is a “balance.” However, the explanation in paragraph 0105 and Figure 10 of the Borho application show that a thresholding is applied to each of the three energy bands individually. Figure 10 shows that the medium energy band (402) is out of balance and paragraph 0105 reports that the “artificial radiation affecting the medium energy NBR channel falls outside of the acceptable limits...” that is, a threshold has been met with one energy channel. Further, the paragraph 0106 says that the NBR technique is supposed to detect “an increase in one part of the spectrum as compared to another.” None of this suggests calculating a correlation across time slices, individual detectors or energy spectra.

With regard to Mallette paragraph 004, the disclosure clearly discourages the technique of combining the detectors as claimed, by means of correlating the detector data. It states that “such a system is limited as it still is not practical for vehicles moving at highway speeds.” As noted in applicant’s affidavit under 35 CFR 132, the invention claimed in this application produces unexpected results: while Mallette notes that the technique described in paragraph 004 only works below 19 MPH, the applicant’s invention has been field tested to work at 75 MPH. “Greater than expected results are evidence of non-obviousness.” MPEP 716.02(a).

Finally, with regard to the claim amendments introducing a threshold selected as a function of the number of time slices or detectors that are examined, antecedence is present based on the disclosure, including on page 5 line 17 and following, and page 8, line 20 and following as well as the inherent mathematical properties associated with the process. Page 5, line 17 contemplates use of “two or more detectors.” Page 5, line 22 describes how sensitivity is increased by correlating over a plurality of time slices. It is contemplated in this disclosure that as more detectors or time slices are examined for correlation, the probability threshold (assuming the probability is the chance of a background source) can be higher. Page 8, line 20 describes the selection of a higher probability threshold by increasing the number of detectors being examined for correlation. The selection of a higher probability threshold is described on page 5, line 23. Similarly, the statement on page 5, line 20, “the required count threshold for a single detector can be set quite low...” is the same thing: a higher threshold for a probability of background is the

same as a lower number of actual counts. That is disclosed by means of Equation 1, which shows that as the counts increase, the probability that they are from background decrease, all other variables equal.

The new claims expressly claim the same invention but expressed in terms of calculating the probability that the radiation counts came from a source (rather than from background). As noted in Examiner's office action, this is equivalent to calculating the probability that the radiation came from background because the probability of the former is one minus the probability of the latter.

Applicant has made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Ted Sabety, Applicant's Attorney at 212 481 8686 so that such issues may be resolved as expeditiously as possible.

Respectfully Submitted,

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Ted Sabety  
Reg. No. 53,540

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Date

Sabety +associates, PLLC  
1500 Broadway, 12<sup>th</sup> fl.  
New York, NY 10036